COMPARISON OF DRY-CLEANING SPONGES USED TO REMOVE SOOT FROM TEXTILES

ALLISON ANDERSON AND MARGARET ORDOÑEZ

ABSTRACT—This tip summarizes a study that compared natural-rubber (e.g., soot sponge) and polyurethane foam (e.g., cosmetic sponge) sponges widely used for dry cleaning textiles that was conducted through the University of Rhode Island Textile Conservation Laboratory. A series of exploratory trials on textiles covered in simulated soot deposits assessed sponge characteristics, efficacy, and potential for damage. The natural-rubber sponges sold for use in conservation failed to outperform polyurethane sponges in all trials. Results suggested that the residue left by natural-rubber sponges makes them unsuitable for use in textile conservation. Further research is needed to determine the long-term suitability of sponges containing alkaline additives.

COMPARACIÓN DE ESPONJAS PARA LIMPIEZA EN SECO, USADAS PARA REMOVER HOLLÍN DE TEXTILES

RESUMEN—Este trabajo resume un estudio que comparó esponjas de hule natural (ej. esponja de hollín) y de poliuretano (ej. esponjas cosméticas), ampliamente utilizadas para la limpieza en seco de textiles. Estas esponjas han sido utilizadas para limpieza de textiles en el Laboratorio de Conservación de Textiles de la Universidad de Rhode Island. Una serie de intentos exploratorios en textiles cubiertos en hollín aplicado de manera intencional fue limpiada con estas esponjas con la finalidad de evaluar su eficacia y el daño que pueden causar. Las esponjas de hule natural, disponibles de manera comercial para uso en el campo de la conservación tuvieron un desempeño inferior a las esponjas de poliuretano. Los resultados sugirieron que el residuo que las esponjas de hule natural deja en la superficie es inadecuado para su uso en conservación de textiles. Se necesita más información para determinar la estabilidad a largo plazo de las esponjas que contienen aditivos alcalinos.

1. INTRODUCTION

Rubber sponges and polyurethane (PU) sponges are both commonly used by conservators when dry cleaning textiles. A published comparison of the characteristics, efficacy, and impact of sponge types to painted canvases did not address garments or other textiles (Daudin-Schotte et al. 2013). This study used textiles with simulated soot deposits to explore the various characteristics of commercially available and conservation-specific sponges, establishing their suitability for textile conservation.

2. METHODS

Materials and methods were chosen through a series of pretests (Anderson 2016). In all pretests and trials, cleaning efficacy was measured as the change in lightness (ΔL) using a spectrophotometer (X-rite model SP62 with Color iQC, v.7).

Sponges were cut into equal-sized 1 cm cubes. Plain-weave cotton fabrics were used as substrates for testing; new fabric was used for the soil-removal tests while 19th century fabric donated to a conservation study collection was used for damage trials. Substrates were soiled using carbon black as an analog for soot; the AATCC Test Method 123-2000, Carpet Soiling: Accelerated Soiling Method (AATCC 2007) was modified by using 2 mm glass balls to minimize damage in the soiling process. To minimize the effects of handling, soiled samples were pinned to foam-core cards and vacuumed at a suction level appropriate for delicate textiles, as determined through pretesting.

Rather than rubbing or rolling the sponges, which can damage textiles by displacing yarns, abrading fibers, and leaving sponge debris, sponges were tamped against the fabric surface in this study. A small-scale test revealed that sponges quickly remove soil before their efficacy reaches a plateau, after which point particulates were redeposited onto the surface of the textile. Sponges removed particulates without redepositing soil between 8 and 16 tamps, after which more tamps with a dirty sponge did not increase the amount of soil removed.

3. SPONGE CHARACTERIZATION

Five sponges were selected for this study to represent the measurable physical characteristics found in dry-cleaning sponges, including composition, structure, and average cell size. Sponges represented those available through conservation supply houses and those marketed for commercial purposes. Two natural-rubber sponges—University Products Dry Cleaning Sponge and Paint USA K-42R Soot and Dirt Remover (fig. 1)—and three polyurethane-foam sponges—University Products Latex-Free Hydrophilic Sponge, Studio 35 Beauty Cosmetic Wedges, and up & up Latex Free Foam Cosmetic Wedges (fig. 2)—were compared.

Sponges were characterized visually based on number of cells in a square centimeter and the average open area of a cell. Composition was further characterized through energy-dispersive x-ray spectroscopy (EDX) analysis that suggested the presence of common sponge additives, either calcium carbonate or aluminum silicate, the presence of which was visible at 1000× (fig. 3). Comparison of these characteristics is found in table 1.

Table 1. Sponge Characteristics

Commercial Name	**Composition**	**Average Cell Size (mm^2)**	**Cells per cm^2**
Paint USA K-42R Soot & Dirt Remover	Natural rubber, calcium carbonate	0.46	132
University Products Dry Cleaning Sponge	Natural rubber, calcium carbonate	0.48	134
Studio 35 Beauty Cosmetic Wedges	PU foam, calcium carbonate	6.7×10^{-3}	8000
up & up Latex-Free Foam Cosmetic Wedges	PU foam	0.031	2300
University Products Latex-Free Hydrophilic Sponge	PU foam, aluminosilicate, titanium oxide	7.8×10^{-3}	6600

Fig. 1. Natural rubber sponge surface, 25× magnification. University Products Dry Cleaning Sponge (top) and Paint USA K-42R Soot & Dirt Remover (bottom).

4. FINDINGS

A series of trials compared sponge types and brands to determine the most appropriate product for soil removal from the surface of textiles. These trials evaluated cleaning efficiency, damage to the surface of the textile, and sponge residue.

Trial 1 tested the cleaning efficacy of the five sponges, comparing lightness before and after treatment. While the Studio 35 Beauty sponge removed statistically significantly more soil than all other sponges, all PU-foam sponges were not better than the two natural-rubber sponges. Physical characteristics appear to be more important than material in choosing a sponge to remove particulate soil, as the sponge with the smallest cells was the most effective.

Trial 2 tested the number of clean sponge surfaces needed to remove the most soil. As demonstrated in trial 1, the Studio 35 Beauty sponge was significantly better than all other sponges. The slope of the ΔL for the all-PU-foam sponges suggests that fresh sponges may continue to remove soil after the first sponge is

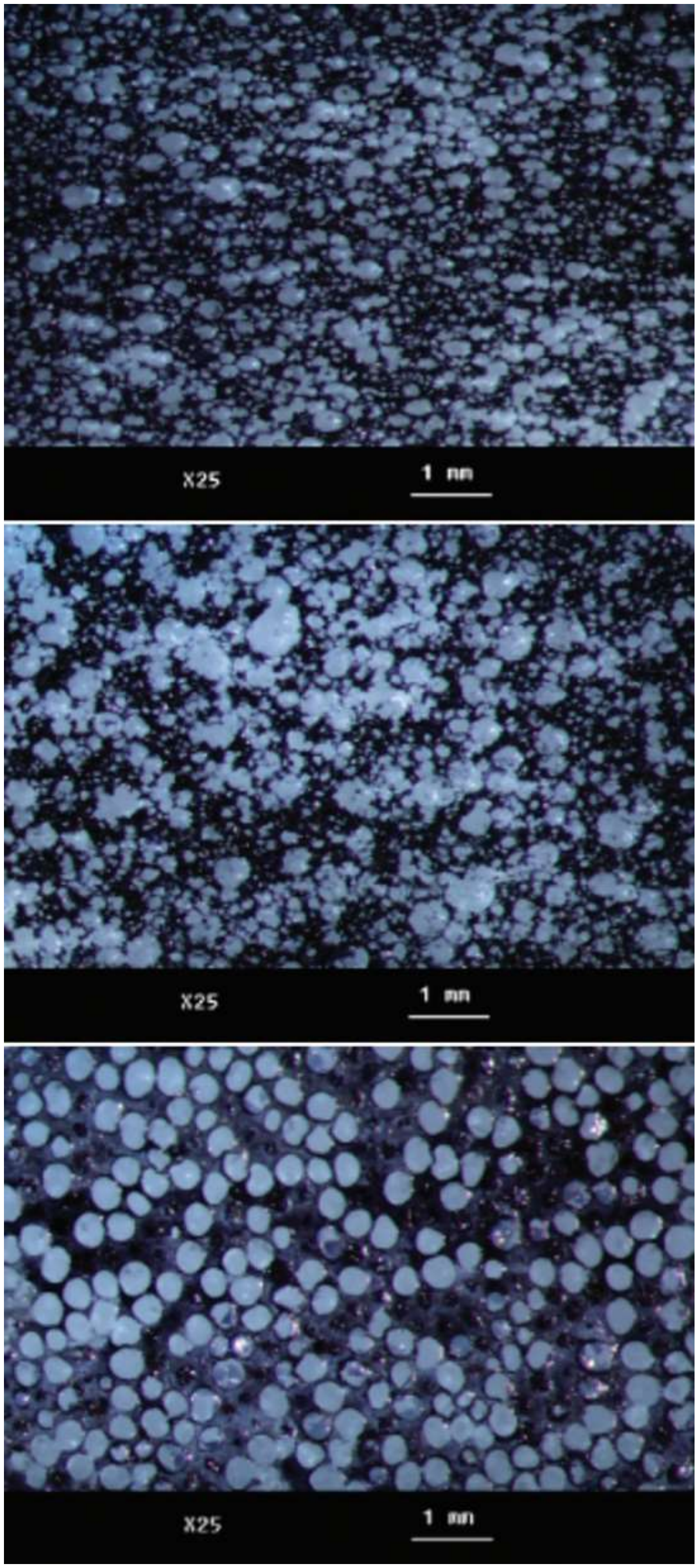

Fig. 2. Polyurethane sponge surface, 25× magnification. University Products Latex-Free Hydrophilic Sponge (top), Studio 35 Beauty Cosmetic Wedges (middle), and up & up Latex Free Foam Cosmetic Wedges (bottom). Sponge surfaces were covered with black ink to make the individual cells more visible.

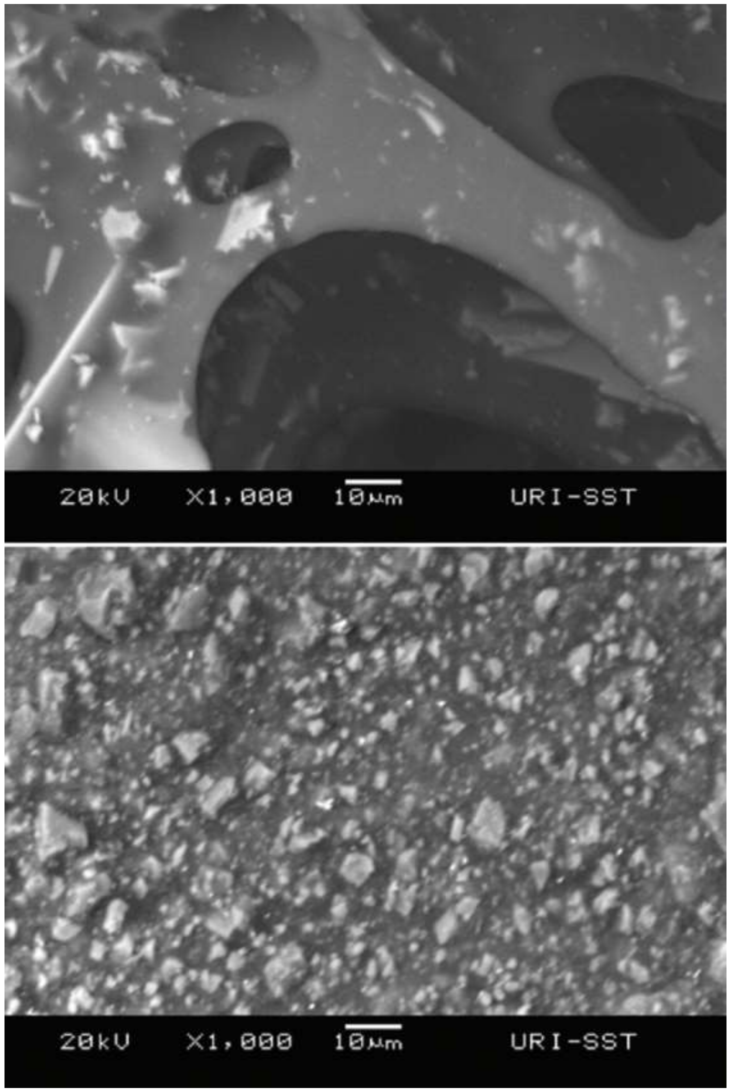

Fig. 3. Sponge surfaces with white structures consistent with calcium carbonate, 1000× magnification. Studio 35 Beauty sponge (top) and University Products Dry Cleaning Sponge (bottom).

exhausted. Data suggested that PU sponges may continue to remove residue after rubber sponges are unable to pick up additional particulates.

Trial 3 evaluated damage to aged textiles through yarn displacements and quantity of fibers dislodged from the yarns, using visual comparison through photomicroscopy. Findings suggested that the tamping action that occurs during sponge cleaning does negligible damage to yarns; all observable differences were less noticeable than those caused by careful handling.

Sponge residue was characterized and measured by tamping sponges onto a clean slide and characterizing the debris left behind. For all sponges, the risk of residue exists and the fragments of sponge or additives redeposited can be as miniscule as soot particulates themselves. Where natural-rubber and PU sponges differed was in the magnitude of particulates deposited on a surface. Within a 20 mm^2 area, PU sponges deposited 30 to 70 particulates, on average, whereas natural rubber produced 500+ particulates; this range of residue is

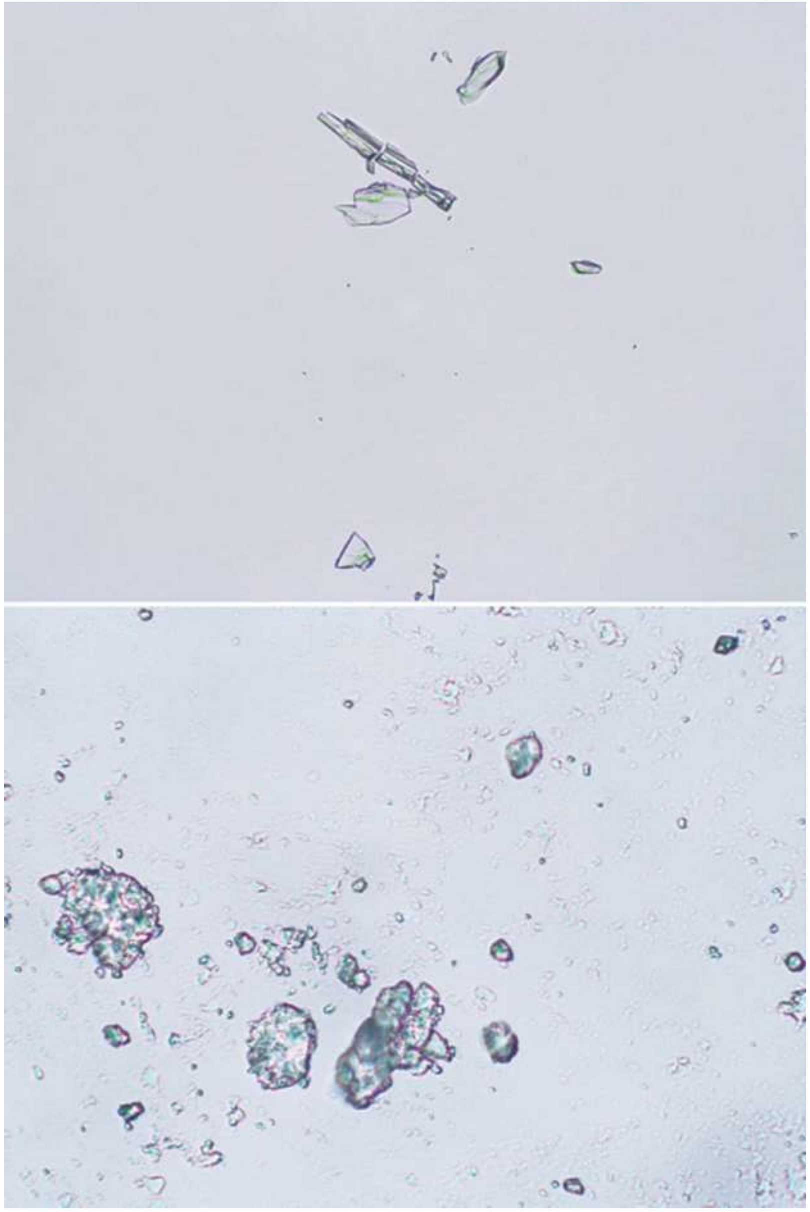

Fig. 4. Sponge debris and additive particulates left behind after tamping. Studio 35 Beauty sponge (top) and Paint USA K-42R Soot & Dirt Remover (bottom).

displayed in figure 4. The size of these particulates makes their removal difficult, if not impossible, raising serious concerns about the quantity of residue produced and deposited by natural-rubber sponges.

5. CONCLUSIONS

Natural-rubber sponges should no longer be used to surface clean any textile. These sponges shed large quantities of particulates, including both sponge material and calcium carbonate additives. While some of these particles might be removed by vacuuming, the strength of suction required to remove them is harsher than recommended for most textiles.

PU sponges may be appropriate for most textiles. Some of these contain and shed small amounts of particulates, consistent with calcium carbonate additives. Sponges that use calcium carbonate or other alkaline fillers may not be suited for use with protein fibers but may still be acceptable for cellulosic fibers.

When using PU sponges, it should be noted that there is a limit to how much soil may be removed. To maximize the amount of soil reduction, clean sponge surfaces should be regularly swapped out after 8 to 16 tamps to avoid redepositing soil onto the textile's surface.

While the results of this study are actionable, further research evaluating the benefits and consequences of using sponges to remove particulate soil as a conservation treatment for textiles is recommended. The methods in this study were exploratory owing to the lack of standardized test methods for evaluating conservation treatment methods. Additionally, this project tested a limited set of materials; continued testing of sponges will be required as product availability changes and manufacturers alter the characteristics of and additives to their sponges.

ACKNOWLEDGMENTS

Research was completed for a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Textiles, Fashion Merchandising and Design at the University of Rhode Island. Special thanks to my committee and the graduate faculty at the University of Rhode Island, most especially my advisor, Dr. Margaret Ordoñez. Additional thanks to Edward Anderson for assistance with statistical analyses and to Anna Rose Keefe for extensive writing support.

REFERENCES

American Association of Textile Chemists and Colorists. 2007. "Carpet soiling: Accelerated soiling method, test method 123-2000." In *AATCC Technical Manual*. Research Triangle Park, NC: American Association of Textile Chemists and Colorists.

Anderson, A. M. 2016. "Comparison of dry cleaning sponges used to remove soot from textiles." Master's thesis, University of Rhode Island, Kingston.

Daudin-Schotte, M., M. Bisschoff, I. Joosten, H. Keulen, and K. Van den Berg. 2013. "Dry cleaning approaches for unvarnished paint surfaces." *New Insights into the Cleaning of Paintings, Proceedings from the Cleaning 2010 International Conference*. Valencia, Spain. 209–19.

SOURCES OF MATERIALS

University Products Dry Cleaning Sponge and Latex-Free Hydrophilic Sponge

University Products, INC.
517 Main St.
Holyoke, MA 01040
www.universityproducts.com

The two commercially available PU sponges tested were store brands purchased at local branches in Rhode Island, while the natural-rubber sponge was purchased at a local hardware store. Corporate addresses are provided below.

up & up Latex Free Foam Cosmetic Wedges
Target Corporation
1000 Nicollet Mall
Minneapolis, MN, 55403
www.target.com

Studio 35 Beauty Cosmetic Wedges
Walgreen Co.
200 Wilmot Rd.
Deerfield, IL 60015
www.walgreens.com

Paint USA K-42R Soot & Dirt Remover
ACE Hardware
2200 Kensington Court
Oak Brook, IL 60523
www.acehardware.com

AUTHOR BIOGRAPHIES

ALLISON ANDERSON completed her Master of Science in Textiles, Fashion Merchandising, and Design at the University of Rhode Island (URI) in 2016 and is currently a research assistant at the Museum of Science, Boston. Address: 100 Bemis Rd., #7, Fitchburg, MA 01420. E-mail: allison.marguerite.anderson@gmail.com

MARGARET ORDOÑEZ, PhD, Professor Emerita, University of Rhode Island, recently retired after teaching graduate textile conservation courses at URI for 29 years. She is continuing to practice textile conservation in her new labs in Tennessee. Address: 21 Bounty Lane, Camden, TN 38320. E-mail: mordonez@uri.edu